USER MANUAL

Accessory 24V Version 2

Axis Expansion Board (New Version)

3Ax-602226-xUx2

January 29, 2004

DELTA TAU
Data Systems, Inc.
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INTRODUCTION

Overview

The ACC-24V Axis Expansion Board provides four or eight channels of PMAC(1)-style servo interface circuitry for PMAC and Turbo PMAC VME controllers. One ACC-24V board can be connected to a single (non-Turbo) PMAC board, providing up to eight additional channels of servo interface circuitry. Up to four ACC-24P boards can be connected to one Turbo PMAC board, providing up to 32 additional channels of servo interface circuitry.

The ACC-24V is a full-sized VME expansion card. It has a VME bus connector (P1), so it can be mounted in a VME expansion slot. The ACC-24V does not communicate over the bus; the bus connector is just a convenience for mounting the board near the PMAC, Turbo or non-Turbo.

The ACC-24V board contains no processor; it has one or two highly-integrated 4-channel PMAC(1)-style Servo ICs with the buffering circuitry and connectors around them.

Compatibility

The ACC-24V can be used with any regular (non-Turbo) PMAC(1) or PMAC2 VME board, interfacing through the expansion port. (It is electrically and software compatible with the PMAC(1)-PCI/ISA and PMAC2-PCI/ISA, but special mounting is required.) PMAC(1) VME controllers have full software support for use of the ACC-24V. PMAC2 controllers do not have I-variables for the automatic setup of ACC-24V registers, and they cannot use the flags on ACC-24V as automatic servo flag inputs and outputs.

The ACC-24V board can be used with any Turbo PMAC(1) or Turbo PMAC2 VME board, interfacing through the Expansion port. (It is electrically and software compatible with Turbo PMAC(1)-PCI/ISA and Turbo PMAC2-PCI/ISA, but special mounting is required.) Note that even if the Turbo PMAC itself is a PMAC2 with the PMAC2-style Servo ICs and interface circuitry, the ACC-24V with its PMAC(1)-style Servo ICs and interface circuitry can be connected to it, with full software support for using its features.

Board Configuration

Base Version

The base version of the ACC-24V provides a VME board with:

- Four channels axis-interface circuitry, each including:
  - 16-bit +/-10V analog output
  - 3-channel differential/single-ended encoder input
  - Four optically isolated input flags, two optically isolated output flags
  - Interface to external 16-bit serial ADC
- 96-pin IDC servo connector
- Expansion port connector to PMAC/Turbo PMAC CPU
- Auxiliary port connector for PMAC hardware clock signals
- On-board hardware clock generation circuitry

Option 1V

ACC-24V can be expanded past the standard four channels of axis-interface circuitry by factory configuration, with the order of Option 1 (part number: 3V1-0ACC24-OPT).

- Option 1V provides four additional channels of axis interface circuitry with a 96-pin connector, identical to the first four channels.

Formal Specifications

Acc-24V

Size:	23.5cm x 16.7 x 1.27cm (9.25" x 6.56" x 0.5")
Weight:	0.326 kg. (0.72 lb.)

Option 1V

Size:	15.6cm x 10.6cm x 1.27cm (6.13" x 4.19" x 0.5")
Standoff height:	1.9cm (0.75")
Weight:	0.155 kg. (0.34 lb.) (With the 4 standoffs)

Temperature	
Operating:	0°C to 60°C (32°F to 140°F)
Storage:	-12°C to 82°C (10°F to 180°F)
Humidity:	10% to 95%, non-condensing

Hardware Updates

Significant upgrades were made to the ACC-24V board in the 602226-102 version. This new version replaces earlier versions of the ACC-24V board, bringing important improvements, which include:

- **Surface-Mount Technology**: Most components are surface mounted for higher reliability and greater long-term part availability.
- **On-Board Clock Generation Circuitry**: This eliminates the need to bring a 2-strand cable from the PMAC-VME J6 to ACC-24P J5 or J6 to provide the hardware clock signals for the encoder inputs and DAC outputs.
- **Daisychain Capability for Turbo PMAC**: Up to four of the new ACC-24V boards may be connected to a single Turbo PMAC CPU on a daisychain expansion port connector using the new S1 addressing DIP-switch bank.
- **Individual Amplifier Enable Polarity Control**: New jumpers E17A-E17D permit individual high-true/low-true control of the four amplifier enable signals. For the extra four channels (5-8) on Option 1, jumpers E17E-E17H permit individual high-true/low-true control of the four amplifier enable signals
- **24V Amplifier Enable Capability**: New Jumper E100 permits use of up to 24V supply for the amplifier, compared to a maximum of 15V on the older version.
- **Sinking or Sourcing Input Flags**: The new ACC-24V allows the use of either sinking or sourcing input flags (home, limits, fault); the old ACC-24V permitted only sinking input flags.
- **Voltage Interlock Circuit**: The new ACC-24V has an interlock circuit that shuts down the analog outputs if it detects anything wrong with the power supply, preventing runaway on partial supply loss.
- **Buffered, Isolated Compare Outputs**: The new J7 10-pin header provides optically isolated outputs for the position compare function for each encoder with outputs rated to 24V and 100mA.

- **Compatibility Issues:** The ACC-24V can be operated in a manner that is 100% compatible with the old ACC-24V. The board is shipped from the factory with settings for 100% compatible operation. To ensure this operation is compatible, double-check the following settings:

- **Clock Generation Circuitry**: To bring the hardware clock signals from the PMAC J6 connector as before, there must be a jumper on E38A, a jumper on E98C, and no jumpers on E34A, E34, E35, E36, E37, E38, E98A, or E98B. To use the on-board clock signals which provide 100% operational compatibility, there must be a jumper on only one of the set {E34A, E34, E35, E36, E37, E38} which select the frequency exactly as on PMAC. There must be a jumper on only one of the set {E98A, E98B}, where E98A selects the same frequency as PMAC E98 pins 1 and 2, and E98B selects the same frequency as PMAC E98 pins 2 and 3; there must be no jumper on E38A or E98C.

- **Daisychain Capability**: To use the ACC-24V with a non-Turbo PMAC-VME, DIP-switches S1-1, S1-2, S1-3 and S1-4 must be in the OFF position.
- **24V Amplifier Enable Capability**: In order for the amplifier enable outputs to use the +12V to +15V analog supply voltage for a high-side clamping supply, jumper E100 must connect pins 1 and 2.
- **Sinking/Sourcing Input Flags**: To use sinking input flags, simply connect the flags as before.

Note:

Because multiples of the new ACC-24V can be used with a single Turbo PMAC, the channel numbers for the ACC-24V on the new documentation are referred to as Channels 1 – 8, instead of 9 – 16 in the documentation for the old version. An individual channel in the system is referred to by both board number and channel number. When a single ACC-24V is used with a regular (non-Turbo) PMAC VME, its Channels 1 – 8 map into PMAC channels 9 – 16, respectively.

HARDWARE SETUP

Output Flag Driver ICs

The output flags on the ACC-24V – both the amplifier-enable (AENA) signals and the position compare (EQU) signals – are driven by socketed ICs. Either sinking driver ICs or sourcing driver ICs may be installed in these sockets. Component U11 contains the driver for the first four channels (AENA); if Option 1 is ordered, component U20 contains the driver for the second four channels (AENA). Component U73 contains the driver for all eight position compare (EQU).

ULN2803A or equivalent sinking driver ICs are installed at the factory. These can be changed in the field to UDN2981A or equivalent sourcing driver ICs. If the ICs are changed, it is essential to change the configuration jumpers: E101 and E102 for U11; E93 and E94 for U73 (See the Output Flag Configuration Jumpers section of this manual).

Switch Configuration

Address DIP Switch S1

S1 is a 4-point DIP switch that determines whether to connect the ACC-24V to a regular (non-Turbo) PMAC or a Turbo PMAC. To enable addressing of the board by a non-Turbo PMAC VME, switches S1-1, S1-2, S1-3 and S1-4 must be OFF on an ACC-24V. This setting is equivalent to operation of the older versions of the ACC-24P board without S1.

To enable addressing of multiple boards by a Turbo PMAC, switches S1-3 and S1-4 must be ON on an ACC-24P. If they are OFF (or an older version of the board is used with a Turbo PMAC), the board will respond to any of the four possible addresses, so no more than one board may be connected to a Turbo PMAC VME.

Additionally, S1 sets up the address of the ACC-24V in Turbo PMAC's memory and I/O map. The setting of these DIP switches must match the addresses used by Turbo PMAC VME; and no two ACC-24V boards connected to the same Turbo PMAC VME may have the same DIP switch settings, or there will be an addressing conflict.

The settings of switches S1-1 and S1-2 define the address of the board in Turbo PMAC's VME address space. This in turn defines the number of the Servo IC(s) on the board, and the I-variable numbers in the Turbo PMAC VME that configure the IC(s). The following table lists the possible settings:

S1-1	S1-2	Board No.	1ST IC No.	2ND IC No.	1st IC I-Variable Range	2nd IC I- Variable Range	1st IC Base Address	2nd IC Base Address
ON	ON	1ST	2	3	I7200-I7299	I7300-I7399	$078200	$078300
OFF	ON	2ND	4	5	I7400-I7499	I7500-I7599	$079200	$079300
ON	OFF	3RD	6	7	I7600-I7699	I7700-I7799	$07A200	$07A300
OFF	OFF	4TH	8	9	I7800-I7899	I7900-I7999	$07B200	$07B300

It is suggested, but not required, that the boards be assigned in order. That is, if there are two ACC-24V boards in the system, the one closest to the Turbo PMAC VME be set up as the first board, and the next one be set up as the second board.

Jumper Configuration

DAC/ADC Clock Signal Source

Jumper E98C must be ON in order to accept the DCLK clock signal for the D/A converters and A/D converters for the ACC-24V from the PMAC VME through J6 pin 9. (On older versions of the ACC-24V, this was the only way to provide the DCLK signal.) The signal comes from the comparable pin on PMAC's JXIO connector.

If Jumper E98C is OFF, the DCLK signal must come from the ACC-24V's own clock generation circuitry. This configuration is strongly recommended to simplify system wiring and to provide more noise immunity. It is completely operationally compatible with the older external clock-source configuration. This internal clock-source configuration is required if there is more than one ACC-24V connected to a single Turbo PMAC VME.

If the internal clock-source configuration is chosen, the signal must come through either jumper E98A or E98B. If E98A is ON (default), the 2.45 MHz frequency is selected. If E98B is ON, the 1.22 MHz frequency is selected. This lower frequency improves the operation of ACC-28 A/D converter boards connected to the ACC-24V. The DCLK frequency on the ACC-24V should be the same as that on the PMAC itself, which is selected by PMAC's E98 jumper.

Only one of the jumpers E98A, E98B, and E98C should be ON at one time.

Encoder Clock Signal Source

Jumper E38A must be ON in order to accept the SCLK clock signal for the encoder circuits on the ACC-24V from the PMAC through J6 pin 10. (On older versions of the ACC-24V, this was the only way to provide the SCLK signal.) The signal comes from the comparable pin on PMAC's JXIO connector.

If Jumper E38A is OFF, the SCLK signal must come from the ACC-24P's own clock generation circuitry. This configuration is recommended to simplify system wiring and to provide more noise immunity. It is operationally compatible with the older external clock-source configuration. This internal clock-source configuration is required if there is more than one ACC-24V connected to a single Turbo PMAC VME.

If the internal clock-source configuration is chosen, the signal must come through one of the jumpers E34(A) through E38. If E34 is ON (default), the 9.83 MHz frequency is selected. The SCLK frequency on the ACC-24V does not have to be the same as that on the PMAC itself, which is selected by PMAC's E34A to E38 (A) jumper bank. The following table lists the frequency selected by each jumper:

E34A	19.66 MHz	**E36**	2.45 MHz
E34	9.83 MHz	**E37**	1.22 MHz
E35	4.92 MHz	**E38**	(External)

Only one of the jumpers E34A through E38A should be ON at one time.

Encoder Input Signal Configuration

Jumpers E27 through E24 control the open-circuit voltage of the complementary input lines A/, B/, and C/ for Encoders 1 through 4, respectively. If Option 1 is ordered, jumpers E18 through E21 do the same for Encoders 5 through 8.

These are 3-point jumpers. If pins 1 and 2 are connected (default), the complementary lines are held at 2.5V if not driven by an input. If pins 2 and 3 are connected, these lines are pulled to 5V if not driven. The main signal lines are always pulled up to 5V if not driven.

For single-ended encoders, these jumpers must connect pins 1 and 2. For differential line-driver encoders, the setting does not matter; usually, the jumpers are left in the default setting of 1-2. The only reasons to change the setting, 2-3, is to connect to complementary open-collector drivers (now nearly obsolete) if external exclusive, or if circuitry is used to detect loss of encoder.

Analog Circuit Isolation

The analog circuitry on the ACC-24V can be isolated from the digital circuitry, or both circuits can be tied to a common reference voltage. It is recommended in actual industrial application that isolation be maintained between the two circuits. To do this, jumpers E85, E87, and E88 must be OFF and separate power supplies must be used for the two circuits.

To tie both circuits to a common reference, jumpers E85, E87, and E88 should be ON. A common power supply may be used for both circuits in this configuration.

Input Flag Supply

There are several possibilities for supplying the power to the input flag (HMFL, -LIM, +LIM, FAULT) circuits. Most commonly, the same +15V supply that is used for the analog output circuitry is used for the input flags. In this configuration, jumper E89 should be ON, and jumper E90 should connect pins 1 and 2. This is the default configuration and it supports sinking drivers only.

A separate supply can be brought in on Pin 9 of J7. For sinking drivers, this can be a +12V to +24V supply; for sourcing drivers, this is the 0V return of the supply. In this configuration, jumper E89 should be OFF, and jumper E90 should connect pins 1 and 2.

In addition, it is possible to use the +12V digital supply from the P1 VME bus connector or the TB1 terminal block. This configuration defeats the optical isolation of the flag receivers and is not recommended for industrial systems. It may be useful for demonstration systems. In this configuration, jumper E90 should connect pins 2 and 3.

Output Flag Supply

There are two possibilities for supplying power to the output flag (AENA, EQU) circuits. Most commonly, the same +15V supply that is used for the analog output circuitry is used for the output flags. In this configuration, jumper E100 should connect pins 1 and 2. This is the default configuration.

A separate supply can be brought in on Pin 9 of J7. This can be a +12V to +24V supply. In this configuration, jumper E100 should connect pins 2 and 3.

Output Flag Signal Configuration

The output flags (AENA and EQU) on the ACC-24V can use either sinking or sourcing drivers. Component U11 drives the flags for the first four channels; if Option 1 is ordered, U20 drives the flags for the last four channels (5-8). ULN2803A or equivalent sinking driver ICs are installed at the factory in the sockets for these components; for the first four channels, U11 baseboard, these may be replaced with UDN2981A or equivalent sourcing drivers. Option 1 can only operate sinking drives, and it is socketed for easy replacement.

CAUTION

Incorrect settings of these jumpers can permanently damage the driver ICs.

Option 1, U20 can be set only for sinking, ULN2803A or equivalent.

If a sinking driver IC is installed in U11, jumper E101 should connect pins 1 and 2; jumper E102 should connect pins 1 and 2. If a sourcing driver IC is installed in U11, jumper E101 should connect pins 2 and 3; jumper E102 should connect pins 2 and 3.

Resistor Pack Configuration

Termination Resistors

The ACC-24V provides sockets for termination resistors on differential input pairs coming into the board. When shipped, there are no resistor packs in these sockets. If these signals are brought long distances into the ACC-24V board and ringing at signal transitions is a problem, SIP resistor packs may be mounted in these sockets to reduce or eliminate the ringing.

All termination resistor packs are the type that has independent resistors (no common connection) with each resistor using two adjacent pins. The following table shows which packs are used to terminate each input device:

Input	Pack	Pack Size
Encoder 1	RP14	6-pin
Encoder 2	RP15	6-pin
Encoder 3	RP16	6-pin
Encoder 4	RP17	6-pin
Option 1V		
CHA5 – CHB5 CHA6 – CHB6	RP19	8-pin
CHB8 – CHB7 CHA7 – CHA8	RP20	8-pin
CHC8 – CHC5 CHC7 – CHC6	RP23	8-pin

Connections

Mounting

The ACC-24V can be mounted in one of two ways: in the VME bus or using the standoffs.

- To mount in the VME bus, insert the P1-VME card connector into the VME socket. If there is a standard VME-style housing, use the bracket at the front plate of the ACC-24V board to screw into the housing to hold the board down firmly.
- For Standoffs, at each of the four corners of the ACC-24V board, use the mounting holes.

Note:

The ACC-24V board does not do any communications through the bus connector; the connector is used for mounting and for power supply. Even in standalone applications, passive backplane boards can be useful for mounting and power supply.

Power Supply Connection

The ACC-24V requires 5V power for its digital circuits: 1A in a 4-channel configuration, 2A in an 8-channel configuration (with Option 1). In addition, it requires a +/-12V to +/-15V supply for the analog output circuits, 150 mA each in a 4-channel configuration, 300 mA each in an 8-channel configuration. The positive analog supply can power the flags; alternately, a separate +12V to +24V supply may be used.

The digital 5V (regulated, +/-5%) power can be provided through one of three paths:

1. Bus connector: If the ACC-24V is mounted in an electrically active VME bus slot, it draws its 5V power from the bus automatically.

2. Terminal block: The TB1 terminal block can be used to bring in 5V power, especially in standalone applications. Point 1 is GND; Point 2 is +5V.
3. P2 - JMACH connectors: Up to 2A may be brought in through each 96-pin JMACH connector from an ACC-8 board or its equivalent, provided the cable is 500 mm (20 in) or less in length.

The analog +/-12V to +/-15V supply can be provided through one of three paths:

1. Bus connector: If the ACC-24V is mounted in an electrically active VME bus slot, it can draw +/-12V power from the bus if jumpers E85, E87, and E88 are all ON. This configuration defeats the optical isolation on the ACC-24V.
2. Terminal block: The TB1 terminal block can be used to bring in +/-12V power, especially in standalone applications if jumpers E85, E87, and E88 are all ON. This configuration defeats the optical isolation on the ACC-24V. Point 1 is GND; Point 3 is +12V; Point 4 is -12V.
3. P2 - JMACH connectors: +/-15V supplies may be brought in on pins A29, A30, and C30 of the 96-pin P2 (JMACH) connector from an ACC-8 board or its equivalent. If this is from a supply isolated from the 5V digital supply, optical isolation can be maintained by making sure jumpers E85, E87, and E88 are all OFF.

The flag +12V to +24V supply can be provided through one of several paths:

- JMACH connector: The +12V to +15V provided on pin 59 of the J8 (JMACH1) connector is also the input flag supply if jumper E89 is ON and E90 connects pins 1 and 2. It is the output flag supply if E100 connects pins 1 and 2.
- JEQU connector: A +12V to +24V supply brought in on pin 9 of the J7 (JEQU) connector, can be used as the input flag supply for sinking flag drivers if E89 is OFF and E90 connects pins 1 and 2. The 0V return line of the supply can be connected to this pin through the same jumpers for sourcing flag drivers. The +12V to +24V supply can be used as the output flag supply if E100 connects pins 2 and 3.
- TB1/VME connector: The +12V provided on point 3 of TB1 or through the P1 VME-bus connector can be used as the input flag supply if E90 connects pins 2 and 3. This defeats isolation of the input flags, and generally should be used only for demonstration systems. In addition, this +12V can be used to supply the output flag drivers if E100 connects pins 2 and 3. E87 must be ON also, defeating the isolation between the digital and analog circuits.

Expansion Port Connection to PMAC

The ACC-24V connects to the PMAC through the 50-pin J1 header on the back of the ACC-24V. A short flat cable connects this to the JEXP header on the PMAC VME CPU piggyback board. If multiple ACC-24V boards are connected to a single PMAC board, they must be connected on a single daisy-chain cable. Total length of this cable should not exceed 300mm (12 in).

Clock Port Connection to PMAC

The J6 (JXIO) connector is a 10-pin IDC header on the ACC-24V. It can be used to bring in the SCLK encoder clock signal and the DCLK DAC/ADC clock signal from the PMAC's matching J6 JXIO connector. A short cable with two 10-pin connectors and four strands is needed to transfer the clocks from the PMAC. This port can be used to receive channel 1 and 3 (9 and 11) encoder feedback signals.

It is recommended that the ACC-24V's internal clock generation circuitry be used. If this circuitry is used (as set by jumpers E34A – E38A and E98A – E98C) and there is no need to use the encoder feedback for channel 9 and 11, this connector does not need to be used. If the connector is used for the position feedback, the ACC-24V's internal clock generation circuitry can still be used as set by the jumpers.

Machine Port Connections

ACC-24V has one (standard) or two (with Option 1) 96-pin VME headers for each set of four servo interface channels. Through this connector, all of the digital signals pass to and from the amplifier, encoder, and flags for the channels. Typically, this header is connected with a matching Delta Tau ACC-8 family PMAC(1)-style 4-channel breakout board or equivalent through a provided 60-pin flat cable.

The machine port connectors are:

- P2 (base board) Board Channels 1 – 4
- P2 (Option 1) Board Channels 5 – 8

ACC-28 / Alternate Port Connections

ACC-24V has one (standard) or two (with Option 1) 16-pin headers that provide connection for A/D-converter signals, as well as alternate pinout for several signals associated with each quartet of servo interface channels.

The main use of the alternate port connector is to provide an interface to an ACC-28A or ACC-28B A/D converter board. The ACC-28 boards can be connected directly to this connector on the ACC-24V through a 16-pin flat cable provided with the ACC-28.

The A/D port connectors are:

- J5 (JS4) Board Channels 1 – 4
- J9 (JS4 ALT) Board Channels 5 – 8

PMAC SOFTWARE SETUP

Use of the ACC-24V requires the proper setup of several I-variables on the regular (non-Turbo) PMAC. These settings are discussed in this section. See the PMAC Software Reference manual for a more detailed description of the variables.

Note:

This manual refers to the eight servo interface channels on the ACC-24V as Channels 1 – 8. When connected to a PMAC VME, these channels map into PMAC as channels 9 – 16, respectively.

Channel Setup I-Variables

Each channel on the ACC-24V has four setup I-variables. The following table lists the I-variable numbers for each channel:

ACC-24V Channel #	1	2	3	4	5	6	7	8
PMAC Channel #	9	10	11	12	13	14	15	16
Encoder Decode I-Var.	I940	I945	I950	I955	I960	I965	I970	I975
Filter Disable I-Var.	I941	I946	I951	I956	I961	I966	I971	I976
Capture Control I-Var.	I942	I947	I952	I957	I962	I967	I972	I977
Flag Select I-Var.	I943	I948	I953	I958	I963	I968	I973	I978

The setup variables work the same on an ACC-24V as on the PMAC (1) itself. The variables are:

Encoder I-Variable 0	Encoder Decode Control	Typically, this variable is set to 3 or 7 for x4 quadrature decode, depending on which way is up.
Encoder I-Variable 1	Encoder Filter Disable	Typically, this variable is set to 0 for digital encoder inputs to keep the filter active, or to 1 when the channel is used with an analog encoder interpolator such as the ACC-8D Opt 8 to disable the filter and synchronize the quadrature and fractional count data.
Encoder I-Variable 2	Capture Control	This variable determines whether the encoder index channel, an input flag, or both, are used for the capture of the encoder position.
Encoder I-Variable 3	Capture Flag Select	This variable determines which input flag is used for encoder capture.

Encoder Conversion Table Entries

To use feedback or master position data from an ACC-24V, entries must be added to the encoder conversion table (ECT) to address and process this data. The default conversion table in the PMAC VME does not contain these entries.

Usually, the position data obtained through an ACC-24V board is an incremental encoder feedback, and occasionally an A/D converter feedback from an ACC-28A/B board connected through the ACC-24V.

The ECT entries for ACC-24V incremental encoder channels are shown in the following table:

ACC-24V Channel #	PMAC Channel #	ECT Entry	ACC-24V Channel #	PMAC Channel #	ECT Entry
1	9	$m0C020	5	13	$m0C030
2	10	$m0C024	6	14	$m0C034
3	11	$m0C028	7	15	$m0C038
4	12	$m0C02C	8	16	$m0C03C

The first hexadecimal digit in the entry, represented by *m* in the table, is a *0* for the most common 1/T timer-based extension of digital incremental encoders. It is an *8* for the parallel-data extension of analog incremental encoders; it is a *C* for no extension of an incremental encoder.

The ECT entries for ACC-28B A/D converters read through an ACC-24P are shown in the following table:

ACC-24V Channel #	PMAC Channel #	ECT Entry	ACC-24V Channel #	PMAC Channel #	ECT Entry
1	9	$mnC026	5	13	$mnC036
2	10	$mnC027	6	14	$mnC037
3	11	$mnC02E	7	15	$mnC03E
4	12	$mnC02F	8	16	$mnC03F

The first hexadecimal digit of the entry, represented by *m* in the above table, is a *1* if the ADC data is processed directly, without integration. It is a *5* if the data is integrated in the conversion. If the entry integrates the data, there is a second line in the entry (another I-variable) that specifies the bias of the A/D converter.

The second hexadecimal digit of the entry, represented by 'n' in the above table, is a '0' if the ACC-28A with signed data is used; it is an '8' if the ACC-28B with unsigned data is used.

Motor Addressing I-Variables

For a PMAC motor to use the servo interface circuitry of the ACC-24V, several of the addressing I-variables for the motor must contain the addresses of registers in the ACC-24V, or the addresses of encoder conversion table registers containing data processed from the ACC-24V. These I-variables can include:

- **Ix02: Motor x Command Output Address** Ix02 tells PMAC where to write its command outputs for Motor x. If ACC-24V is to create the command signals, Ix02 must contain the address of the register. The following table shows the address of the DAC output register for each channel of each ACC-24V. These addresses can be used for single analog outputs or double analog outputs.

ACC-24V Channel #	PMAC Channel #	Ix02 Value	ACC-24V Channel #	PMAC Channel #	Ix02 Value
1	9	$C023	5	13	$C033
2	10	$C022	6	14	$C032
3	11	$C02B	7	15	$C03B
4	12	$C02A	8	16	$C03A

When using a pair of DACs for sine-wave outputs, Ix02 contains the address of the higher-numbered DAC of the pair (the lower address).

- **Ix03: Motor x Position-Loop Feedback Address**
- **Ix04: Motor x Velocity-Loop Feedback Address**

- **Ix05: Motor x Master Position Address** Usually, the Ix03, Ix04, and Ix05 variables contain the address of a processed position value in the encoder conversion table, even when the raw data comes from the ACC-24V.

- **Ix10: Motor x Power-On Position Address** Ix10 tells the Turbo PMAC VME where to read absolute power-on position, if any. Typically, the only times Ix10 will contain the address of an ACC-24V register is if the position is obtained from an A/D converter on an ACC-28A/B connected through the ACC-24V.

The following table shows the possible values of Ix10 for ACC-28 A/D converters:

ACC-24V Channel #	PMAC Channel #	Ix10 Value	ACC-24V Channel #	PMAC Channel #	Ix10 Value
1	9	$m1C023	5	13	$m1C033
2	10	$m1C022	6	14	$m1C032
3	11	$m1C02B	7	15	$m1C03B
4	12	$m1C02A	8	16	$m1C03A

The first hexadecimal digit of the variable, represented by *m* in the above table, is a *3* if the ACC-28B, which provides unsigned data, is used. It is a *B* if ACC-28A which provides signed data, is used.

- **Ix25: Motor x Flag Address** Ix25 tells PMAC where to access its flag data for Motor x. If ACC-24P interfaces to the flags, Ix25 must contain the address of the flag register in ACC-24P. The following table shows the address of the flag register for each channel of each ACC-24P:

ACC-24V Channel #	PMAC Channel #	Ix25 Value	ACC-24V Channel #	PMAC Channel #	Ix25 Value
1	9	$mnC020	5	13	$mnC030
2	10	$mnC024	6	14	$mnC034
3	11	$mnC028	7	15	$mnC038
4	12	$mnC02C	8	16	$mnC03C

The first two digits of Ix25 represented by *m* and *n* in the above table, control how the flags at the specified address are used. Refer to the PMAC Software Reference Manual for details.

- **Ix81: Motor x Power-On Phase Position Address** Ix81 tells PMAC VME where to read absolute power-on position for motor phase commutation if any. Typically, it will contain the address of an ACC-24V register for only two types of absolute phasing sensors. The hall-effect commutation sensors (or their optical equivalents) connected to the U, V, and W input flags on an ACC-24V channel, or the encoder counter filled by simulated quadrature from a Yaskawa absolute encoder connected to the ACC-24V through an ACC-8D Option 9 board.

  The following table contains the possible settings of Ix81 for hall sensor absolute position with an ACC-24V:

ACC-24V Channel #	PMAC Channel #	Ix81 Value	ACC-24V Channel #	PMAC Channel #	Ix81 Value
2	10	$mnC024	6	14	$mnC034
4	12	$mnC02C	8	16	$mnC03C

  The following table contains the possible settings of Ixx81 to read the encoder counters for Yaskawa absolute encoders:

ACC-24V Channel #	PMAC Channel #	Ix81 Value	ACC-24V Channel #	PMAC Channel #	Ix81 Value
1	9	$58C021	5	13	$58C031
2	10	$58C025	6	14	$58C035
3	11	$58C029	7	15	$58C039
4	12	$58C02D	8	16	$58C03D

- **Ix83: Motor x Phase Position Address** Ix83 tells PMAC VME where to get its commutation position feedback every phase update cycle. Usually, this contains the address of an encoder phase position register.

  The following table shows the possible values of Ix83 for ACC-24V encoder phase position registers:

ACC-24V Channel #	PMAC Channel #	X	Ix83 Value
1	9	5	$C021
3	11	6	$C029
5	13	7	$C031
7	15	8	$C039

TURBO PMAC VME SOFTWARE SETUP

Use of the ACC-24V requires the proper setup of several I-variables on the Turbo PMAC VME. These settings are discussed in this section. See the Turbo PMAC Software Reference manual for more detailed descriptions of the variables.

Servo IC Configuration I-Variables

Turbo PMAC I-variables in the range I7000 – I7999 control the configuration of the Servo ICs. The hundred's digit represents the number of the Servo IC (0 to 9) in the system. Servo ICs 0 and 1 are (or can be) on board the Turbo PMAC board itself. Servo ICs 2 through 9 are (or can be) on external devices such as the ACC-24V.

Servo IC Numbering

The number *m* of the Servo IC on the ACC-24V board is dependent on the addressing of the board with DIP switches S1-1 and S1-2, which place the board as the first, second, third, or fourth external device:

- First ACC-24P: Servo IC 2 (Standard); Servo IC 3 (Option 1V)
- Second ACC-24P: Servo IC 4 (Standard); Servo IC 5 (Option 1V)
- Third ACC-24P: Servo IC 6 (Standard); Servo IC 7 (Option 1V)
- Fourth ACC-24P: Servo IC 8 (Standard); Servo IC 9 (Option 1V)

The Standard Servo IC on an ACC-24V occupies Channels 1 – 4 on the board, using connectors P2 (JMACH). The Option 1 Servo IC on an ACC-24V occupies Channels 5 – 8 on the board, using connectors P2 (JMACH) on the piggyback board.

For example, the Standard Servo IC on the first ACC-24V is Servo IC 2 to Turbo PMAC VME and is configured by variables I7200 – I7299.

Servo Channel Numbering

Each Servo IC has four channels of servo interface circuitry. The ten's digit *n* of the I-variable configuring the IC represents the channel number on the IC (n = 1 to 4). For example, Channel 1 of the Standard Servo IC on the first ACC-24V is configured by variables I7210 – I7219. These channel-specific I-variables are represented generically as I7mn0 – I7mn9, where *m* represents the Servo IC number (0 – 9) and *n* represents the IC channel number (1 – 4).

The Channels 1 – 4 on the Standard Servo IC of an ACC-24V correspond to Channels 1 – 4, respectively, on the ACC-24V board itself. The Channels 1 – 4 on the Option 1 Servo IC on an ACC-24V correspond to Channels 5 – 8, respectively, on the ACC-24V board.

Single-Channel I-Variables

The single-channel setup I-variables for Channel *n* of Servo IC *m* work exactly the same on an ACC-24V as they do on a Turbo PMAC(1) itself. These are:

- **I7mn0: Servo IC m Channel n Encoder Decode Control** Typically, I7mn0 is set to 3 or 7 for x4 quadrature decode, depending on which way is up.
- **I7mn1: Servo IC m Channel n Encoder Filter Disable** Typically, I7mn1 is set to 0 for digital encoder inputs to keep the filter active, or to 1 when the channel is used with an analog encoder interpolator such as the ACC-8D Opt 8, to disable the filter and synchronize the quadrature and fractional count data.
- **I7mn2: Servo IC m Channel n Capture Control** I7mn2 determines whether the encoder index channel, an input flag, or both are used for the capture of the encoder position.

- **I7mn3: Servo IC m Channel n Capture Flag Select** I7mn3 determines which input flag is used for encoder capture, if one is used.

Encoder Conversion Table I-Variables

To use feedback or master position data from an ACC-24V, entries must be added to the encoder conversion table (ECT) using I-variables I8000 – I8191 to address and process this data. The default conversion table in the Turbo PMAC does not contain these entries.

Usually, the position data obtained through an ACC-24V board is an incremental encoder feedback, and occasionally an A/D converter feedback from an ACC-28A/B board connected through the ACC-24P.

The ECT entries for ACC-24V incremental encoder channels are shown in the following table:

Encoder Channel #	1st ACC-24V	2nd ACC-24V	3rd ACC-24V	4th ACC-24V
Channel 1	$m78200	$m79200	$m7A200	$m7B200
Channel 2	$m78204	$m79204	$m7A204	$m7B204
Channel 3	$m78208	$m79208	$m7A208	$m7B208
Channel 4	$m7820C	$m7920C	$m7A20C	$m7B20C
Channel 5	$m78300	$m79300	$m7A300	$m7B300
Channel 6	$m78304	$m79304	$m7A304	$m7B304
Channel 7	$m78308	$m79308	$m7A308	$m7B308
Channel 8	$m7830C	$m7930C	$m7A30C	$m7B30C

The first hexadecimal digit in the entry, represented by *m* in the table, is a *0* for the most common 1/T timer-based extension of digital incremental encoders. It is an *8* for the parallel-data extension of analog incremental encoders. It is a *C* for no extension of an incremental encoder.

The ECT entries for ACC-28B A/D converters read through an ACC-24V are shown in the following table:

Register	1st ACC-24V	2nd ACC-24V	3rd ACC-24V	4th ACC-24V
ADC 1	$mn8206	$mn9206	$mnA206	$mnB206
ADC 2	$mn8207	$mn9207	$mnA207	$mnB207
ADC 3	$mn820E	$mn920E	$mnA20E	$mnB20E
ADC 4	$mn820F	$mn920F	$mnA20F	$mnB20F
ADC 5	$mn8306	$mn9306	$mnA306	$mnB306
ADC 6	$mn8307	$mn9307	$mnA307	$mnB307
ADC 7	$mn830E	$mn930E	$mnA30E	$mnB30E
ADC 8	$mn830F	$mn930F	$mnA30F	$mnB30F

The first hexadecimal digit of the entry, represented by *m* in the above table, is a *1* if the ADC data is processed directly, without integration. It is a *5* if the data is integrated in the conversion. If the entry integrates the data, there is a second line in the entry (another I-variable) that specifies the bias of the A/D converter.

The second hexadecimal digit of the entry, represented by *n* in the above table, is a *7* if the ACC-28A with signed data is used; it is an *F* if the ACC-28B with unsigned data is used.

Motor Addressing I-Variables

For a Turbo PMAC motor to use the servo interface circuitry of the ACC-24V, several of the addressing I-variables for the motor must contain the addresses of registers in the ACC-24V, or the addresses of encoder conversion table registers containing data processed from the ACC-24V. These I-variables can include:

- **Ixx02: Motor xx Command Output Address** Ixx02 tells Turbo PMAC where to write its command outputs for Motor xx. If ACC-24V is to create the command signals, Ixx02 must contain the address of the register. The following table shows the address of the DAC output register for each channel of each ACC-24V. These addresses can be used for single analog outputs or double analog outputs.

ACC-24V Register: Board No. & Channel	Address / Ixx02 Value	PMAC Default for:	ACC-24V Register: Board No. and Channel	Address / Ixx02 Value	PMAC Default
1st ACC-24V DAC1	$078203	I902	3rd ACC-24V DAC1	$07A203	I2502
1st ACC-24V DAC2	$078202	I1002	3rd ACC-24V DAC2	$07A202	I2602
1st ACC-24V DAC3	$07820B	I1102	3rd ACC-24V DAC3	$07A20B	I2702
1st ACC-24V DAC4	$07820A	I1202	3rd ACC-24V DAC4	$07A20A	I2802
1st ACC-24V DAC5	$078303	I1302	3rd ACC-24V DAC5	$07A303	I2902
1st ACC-24V DAC6	$078302	I1402	3rd ACC-24V DAC6	$07A302	I3002
1st ACC-24V DAC7	$07830B	I1502	3rd ACC-24V DAC7	$07A30B	I3102
1st ACC-24V DAC8	$07830A	I1602	3rd ACC-24V DAC8	$07A30A	I3202
2nd ACC-24V DAC1	$079203	I1702	4th ACC-24V DAC1	$07B203	--
2nd ACC-24V DAC2	$079202	I1802	4th ACC-24V DAC2	$07B202	--
2nd ACC-24V DAC3	$07920B	I1902	4th ACC-24V DAC3	$07B20B	--
2nd ACC-24V DAC4	$07920A	I2002	4th ACC-24V DAC4	$07B20A	--
2nd ACC-24V DAC5	$079303	I2102	4th ACC-24V DAC5	$07B303	--
2nd ACC-24V DAC6	$079302	I2202	4th ACC-24V DAC6	$07B302	--
2nd ACC-24V DAC7	$07930B	I2302	4th ACC-24V DAC7	$07B30B	--
2nd ACC-24V DAC8	$07930A	I2402	4th ACC-24V DAC8	$07B30A	--

- **Ixx03: Motor xx Position-Loop Feedback Address**
- **Ixx04: Motor xx Velocity-Loop Feedback Address**
- **Ixx05: Motor xx Master Position Address** Usually, the Ixx03, Ixx04, and Ixx05 variables contain the address of a processed position value in the encoder conversion table, even when the raw data comes from the ACC-24V.
- **Ixx10: Motor xx Power-On Position Address** Ixx10 tells the Turbo PMAC where to read absolute power-on position, if any. Typically, the only times Ixx10 will contain the address of an ACC-24V register is if the position is obtained from an A/D converter on an ACC-28A/B connected through the ACC-24V.

The following table shows the possible values of Ixx10 for ACC-28 A/D converters:

Ixx10 Values for PMAC(1)-Style ADC Registers
(Ixx95=$310000 for ACC-28A; =$B10000 for ACC-28B)

Register	1st ACC-24V	2nd ACC-24V	3rd ACC-24V	4th ACC-24V
ADC 1	$078206	$079206	$07A206	$07B206
ADC 2	$078207	$079207	$07A207	$07B207
ADC 3	$07820E	$07920E	$07A20E	$07B20E
ADC 4	$07820F	$07920F	$07A20F	$07B20F
ADC 5	$078306	$079306	$07A306	$07B306
ADC 6	$078307	$079307	$07A307	$07B307
ADC 7	$07830E	$07930E	$07A30E	$07B30E
ADC 8	$07830F	$07930F	$07A30F	$07B30F

- **Ixx24: Motor xx Flag Mode** Ixx24 tells Turbo PMAC how to read and use the flags for Motor xx that are in the register specified by Ixx25. Ixx24 is a set of independent control bits. There are two bits that must be set correctly to use a flag set on an ACC-24V.

- Bit 0 of Ixx24 must be set to 0 to tell the Turbo PMAC that this flag set is in a Type 0 PMAC(1)-style Servo IC. Bit 18 of Ixx24 must be set to 0 to tell the Turbo PMAC that this flag set is not transmitted over a MACRO ring. Other bits of Ixx24 may be set as desired for a particular application.

- **Ixx25: Motor xx Flag Address** Ixx25 tells Turbo PMAC where to access its flag data for Motor xx. If ACC-24V is interface to the flags, Ixx25 must contain the address of the flag register in ACC-24V. The following table shows the address of the flag register for each channel of each ACC-24V.

ACC-24V Register: Board No. & Channel	Address / Ixx25 Value	PMAC Default for:	ACC-24V Register: Board No. & Channel	Address / Ixx25 Value	PMAC Default for:
1st ACC-24V Flag Set 1	$078200	I925	3rd ACC-24V Flag Set 1	$07A200	I2525
1st ACC-24V Flag Set 2	$078204	I1025	3rd ACC-24V Flag Set 2	$07A204	I2625
1st ACC-24V Flag Set 3	$078208	I1125	3rd ACC-24V Flag Set 3	$07A208	I2725
1st ACC-24V Flag Set 4	$07820C	I1225	3rd ACC-24V Flag Set 4	$07A20C	I2825
1st ACC-24V Flag Set 5	$078300	I1325	3rd ACC-24V Flag Set 5	$07A300	I2925
1st ACC-24V Flag Set 6	$078304	I1425	3rd ACC-24V Flag Set 6	$07A304	I3025
1st ACC-24V Flag Set 7	$078308	I1525	3rd ACC-24V Flag Set 7	$07A308	I3125
1st ACC-24V Flag Set 8	$07830C	I1625	3rd ACC-24V Flag Set 8	$07A30C	I3225
2nd ACC-24V Flag Set 1	$079200	I1725	4th ACC-24V Flag Set 1	$07B200	--
2nd ACC-24V Flag Set 2	$079204	I1825	4th ACC-24V Flag Set 2	$07B204	--
2nd ACC-24V Flag Set 3	$079208	I1925	4th ACC-24V Flag Set 3	$07B208	--
2nd ACC-24V Flag Set 4	$07920C	I2025	4th ACC-24V Flag Set 4	$07B20C	--
2nd ACC-24V Flag Set 5	$079300	I2125	4th ACC-24V Flag Set 5	$07B300	--
2nd ACC-24V Flag Set 6	$079304	I2225	4th ACC-24V Flag Set 6	$07B304	--
2nd ACC-24V Flag Set 7	$079308	I2325	4th ACC-24V Flag Set 7	$07B308	--
2nd ACC-24V Flag Set 8	$07930C	I2425	4th ACC-24V Flag Set 8	$07B30C	--

- **Ixx81: Motor xx Power-On Phase Position Address** Ixx81 tells Turbo PMAC where to read absolute power-on position for motor phase commutation if any. Typically, it will contain the address of an ACC-24V register for only two types of absolute phasing sensors. The hall-effect commutation sensors (or their optical equivalents) connected to the U, V, and W input flags on an ACC-24V channel, or the encoder counter filled by simulated quadrature from a Yaskawa absolute encoder connected to the ACC-24V through an ACC-8D Option 9 board.

  The following table contains the possible settings of Ixx81 for hall sensor absolute position with an ACC-24V:

Turbo PMAC Ixx81 ACC-24V Hall Phasing Settings

(Ix91=$800000 - $FF0000)

Hall Flag Channel #	1st ACC-24V	2nd ACC-24V	3rd ACC-24V	4th ACC-24V
Channel 2	$078204	$079204	$07A204	$07B204
Channel 4	$07820C	$07920C	$07A20C	$07B20C
Channel 6	$078304	$079304	$07A304	$07B304
Channel 8	$07830C	$07930C	$07A30C	$07B30C

The following table contains the possible settings of Ixx81 to read the encoder counters for Yaskawa absolute encoders:

Turbo PMAC Ixx81 ACC-24V Encoder Register Settings

(Ix91=$480000 - $580000)

Encoder Register Channel #	1st ACC-24V	2nd ACC-24V	3rd ACC-24V	4th ACC-24V
Channel 1	$078201	$079201	$07A201	$07B201
Channel 2	$078205	$079205	$07A205	$07B205
Channel 3	$078209	$079209	$07A209	$07B209
Channel 4	$07820D	$07920D	$07A20D	$07B20D
Channel 5	$078301	$079301	$07A301	$07B301
Channel 6	$078305	$079305	$07A305	$07B305
Channel 7	$078309	$079309	$07A309	$07B309
Channel 8	$07830D	$07930D	$07A30D	$07B30D

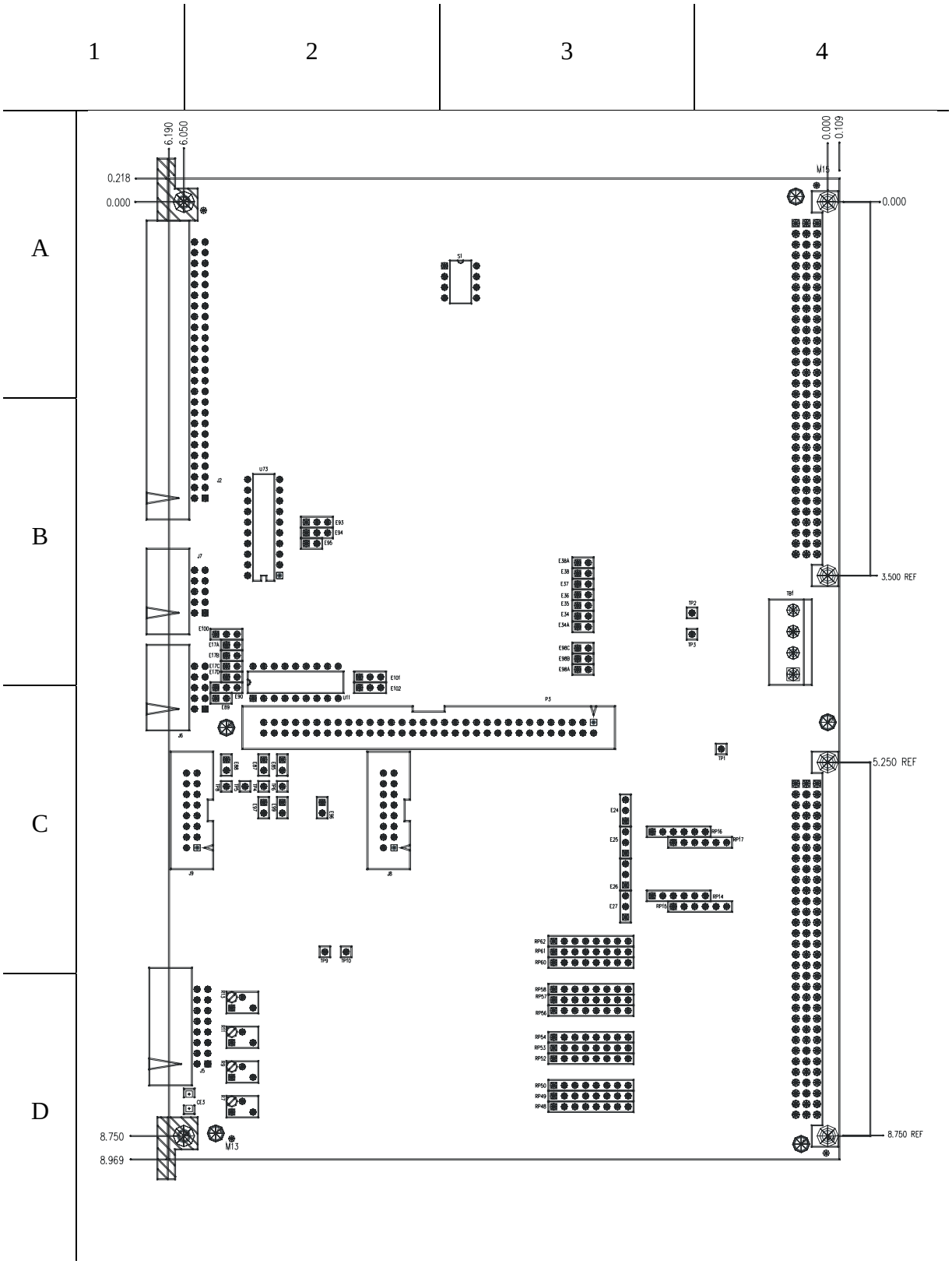
- **Ixx83: Motor xx Phase Position Address** Ixx83 tells Turbo PMAC where to get its commutation position feedback every phase update cycle. Usually, this contains the address of an encoder phase position register.

  The following table shows the possible values of Ixx83 for ACC-24V encoder phase position registers:

Turbo PMAC Ixx83 ACC-24V Encoder Register Settings

Encoder Register Channel #	1st ACC-24V	2nd ACC-24V	3rd ACC-24V	4th ACC-24V
Channel 1	$078201	$079201	$07A201	$07B201
Channel 2	$078205	$079205	$07A205	$07B205
Channel 3	$078209	$079209	$07A209	$07B209
Channel 4	$07820D	$07920D	$07A20D	$07B20D
Channel 5	$078301	$079301	$07A301	$07B301
Channel 6	$078305	$079305	$07A305	$07B305
Channel 7	$078309	$079309	$07A309	$07B309
Channel 8	$07830D	$07930D	$07A30D	$07B30D

ACC-24V LAYOUT/DIMENSIONS



ACC-24V JUMPER AND SWITCH DESCRIPTION

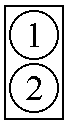
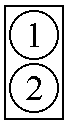
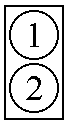
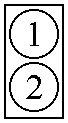
S1: Board Addressing DIP Switch Bank

Switch	Location	Description	Default
S1-1	A3	Use S1-1 and S1-2 select Acc-24V address on Turbo PMAC's expansion port according to the following table: Set S1-1, S1-2, S1-3, S1-4 to OFF position when connecting to regular (non-Turbo) PMAC.	ON
S1-2	A3	Use S1-1 and S1-2 select Acc-24V address on Turbo PMAC'S expansion port according to the following table: Set S1-1, S1-2, S1-3, S1-4 to OFF position when connecting to regular (non-Turbo) PMAC.	ON
S1-3	A3	Board expansion port address enable: Set S1-3 to ON position when connecting to Turbo PMAC/PMAC2; enables addressing of multiple Acc-24 boards. Set S1-1, S1-2, S1-3, S1-4 to OFF position when connecting to regular (non-Turbo) PMAC.	ON
S1-4	A3	Board expansion port address enable: Set S1-3 to ON position when connecting to Turbo PMAC/PMAC2; enables addressing of multiple Acc-24 boards. Set S1-1, S1-2, S1-3, S1-4 to OFF position when connecting to regular (non-Turbo) PMAC.	ON

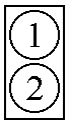
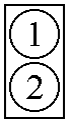
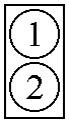
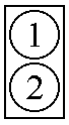
Addressing of ACC-24 Boards For Turbo PMAC

S1-1	S1-2	S1-3	S1-4	Board No.	1ST IC No.	2ND IC No.	1ST IC Base Address	2ND IC Base Address
ON	ON	ON	ON	1ST	2	3	$078200	$078300
OFF	ON	ON	ON	2ND	4	5	$079200	$079300
ON	OFF	ON	ON	3RD	6	7	$07A200	$07A300
OFF	OFF	ON	ON	4TH	8	9	$07B200	$07B300

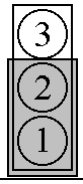
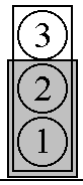
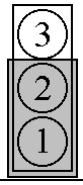
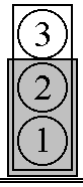
E17A-D: Individual Amplifier Enable/Direction Polarity Control

E Point & Physical Layout	Location	Description	Default
E17A 	B2	Jump pins 1-2 for non-conducting-on-enable AENA1 when global jumper E17 is ON (default); for conducting-on-enable AENA1 when E17 is OFF. Remove jumper for conducting-on-enable AENA1 when global jumper E17 is ON (default); for non-conducting-on-enable AENA1 when E17 is OFF.	No jumper installed
E17B 	B2	Jump pins 1-2 for non-conducting-on-enable AENA2 when global jumper E17 is ON (default); for conducting-on-enable AENA2 when E17 is OFF. Remove jumper for conducting-on-enable AENA2 when global jumper E17 is ON (default); for non-conducting-on-enable AENA2 when E17 is OFF.	No jumper installed
E17C 	C2	Jump pins 1-2 for non-conducting-on-enable AENA3 when global jumper E17 is ON (default); for conducting-on-enable AENA3 when E17 is OFF. Remove jumper for conducting-on-enable AENA3 when global jumper E17 is ON (default); for non-conducting-on-enable AENA3 when E17 is OFF.	No jumper installed
E17D 	C2	Jump pins 1-2 for non-conducting-on-enable AENA4 when global jumper E17 is ON (default); for conducting-on-enable AENA4 when E17 is OFF. Remove jumper for conducting-on-enable AENA4 when global jumper E17 is ON (default); for non-conducting-on-enable AENA4 when E17 is OFF.	No jumper installed
Note: The default ULN2803A sinking drivers have a low output voltage when conducting and can pull high when not conducting. The optional UDN2981A sourcing drivers have a high output voltage when conducting and can pull low when not conducting.			

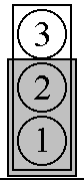
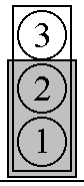
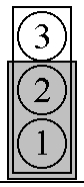
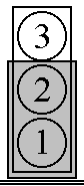
E17E-H: Individual Amplifier Enable/Direction Polarity Control (Option 1 Required)

E Point & Physical Layout	Location	Description	Default
E17E 	Option 1 Board	Jump pins 1-2 for non-conducting-on-enable AENA5 when global jumper E17 is ON (default); for conducting-on-enable AENA5 when E17 is OFF. Remove jumper for conducting-on-enable AENA5 when global jumper E17 is ON (default); for non-conducting-on-enable AENA5 when E17 is OFF.	No jumper installed
E17F 	Option 1 Board	Jump pins 1-2 for non-conducting-on-enable AENA6 when global jumper E17 is ON (default); for conducting-on-enable AENA6 when E17 is OFF. Remove jumper for conducting-on-enable AENA6 when global jumper E17 is ON (default); for non-conducting-on-enable AENA6 when E17 is OFF.	No jumper installed
E17G 	Option 1 Board	Jump pins 1-2 for non-conducting-on-enable AENA7 when global jumper E17 is ON (default); for conducting-on-enable AENA7 when E17 is OFF. Remove jumper for conducting-on-enable AENA7 when global jumper E17 is ON (default); for non-conducting-on-enable AENA7 when E17 is OFF.	No jumper installed
E17H 	Option 1 Board	Jump pins 1-2 for non-conducting-on-enable AENA8 when global jumper E17 is ON (default); for conducting-on-enable AENA8 when E17 is OFF. Remove jumper for conducting-on-enable AENA8 when global jumper E17 is ON (default); for non-conducting-on-enable AENA8 when E17 is OFF.	No jumper installed
Note: The default ULN2803A sinking drivers have a low output voltage when conducting and can pull high when not conducting. The optional UDN2981A sourcing drivers have a high output voltage when conducting and can pull low when not conducting.			

E18 - E21: Encoder Single-Ended/Differential Control (Option 1 Required)

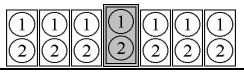
E Point & Physical Layout	Location	Description	Default
E18 	Option 1 Board	ENC 8 through 5: Jump pin 1 to 2 to tie complementary encoder inputs to 2.5V.	1-2 Jumper installed for E18 - E21.
E19 	Option 1 Board	Jump pin 2 to 3 to tie complementary encoder inputs to 5V. For no encoder connection: Jump pin 1 to 2.	E18: ENC 5 E19: ENC 6 E20: ENC 7 E21: ENC 8
E20 	Option 1 Board	For single-ended encoders: Jump pin 1 to 2. For differential line-driver encoders: Do not care.	
E21 	Option 1 Board	For complementary open-collector encoders: Jump pin 2 to 3.	

E24 - E27: Encoder Single-Ended/Differential Control

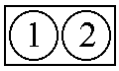
E Point & Physical Layout	Location	Description	Default
E24 	C3	ENC 4 through 1: Jump pin 1 to 2 to tie complementary encoder inputs to 2.5V.	1-2 Jumper installed for E24 - E27.
E25 	C3	Jump pin 2 to 3 to tie complementary encoder inputs to 5V. For no encoder connection: Jump pin 1 to 2.	E24: ENC 4 E25: ENC 3 E26: ENC 2 E27: ENC 1
E26 	C3	For single-ended encoders: Jump pin 1 to 2. For differential line-driver encoders: Do not care.	
E27 	C3	For complementary open-collector encoders: Jump pin 2 to 3.	

E34 - E38: Encoder Sampling Clock Frequency Control

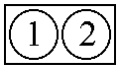
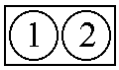
Jumpers E34 - E38 control the encoder-sampling clock (SCLK) used by the gate array ICs. No more than one of these seven jumpers may be on at a time.

							SCLK Clock Frequency	Default & Physical Layout
E36	**E35**	**E34A**	**E34**	**E37**	**E38**	**E38A**		**E36 E35 E34A E34 E37 E38 E38A** 
OFF	OFF	ON	OFF	OFF	OFF	OFF	19.6608 MHz	
OFF	OFF	OFF	ON	OFF	OFF	OFF	9.8304 MHz	E34 ON
OFF	ON	OFF	OFF	OFF	OFF	OFF	4.9152 MHz	
ON	OFF	OFF	OFF	OFF	OFF	OFF	2.4576 MHz	
OFF	OFF	OFF	OFF	ON	OFF	OFF	1.2288 MHz	
OFF	OFF	OFF	OFF	OFF	ON	OFF	External Clock 1 to 30 MHz maximum input on CHC4 & CHC4/	
OFF	OFF	OFF	OFF	OFF	OFF	ON	Clock from PMAC, input on J5 OR J6 PIN 9 from PMAC	

E85: Host-Supplied Analog Power Source Enable

E Point & Physical Layout	Location	Description	Default
E85 	C2	Jump pin 1 to pin 2 to allow A+14V to come from VME bus (ties amplifier and PMAC-VME power supply together. Defeats OPTO coupling.). Note that if E85 is changed, E88 and E87 must also be changed. Also, see E90.	No jumper

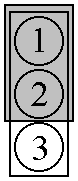
E87 - E88: Host-Supplied Analog Power Source Enable

E Point & Physical Layout	Location	Description	Default
E87 	C2	Jump pin 1 to pin 2 to allow AGND to come from VME bus (ties amplifier and PMAC-VME GND together. Defeats OPTO coupling.). Note that if E87 is changed, E85 and E88 must also be changed. Also, see E90.	No jumper
E88 	C2	Jump pin 1 to pin 2 to allow A-14V to come from VME bus (ties amplifier and PMAC-VME power supply together. Defeats OPTO coupling.). Note that if E88 is changed; E87 and E85 must also be changed. Also, see E90.	No jumper

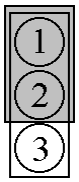
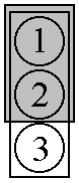
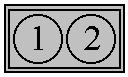
E89: Analog Supply for Input Flag Select

E Point & Physical Layout	Location	Description	Default
E89 	C2	Jump pin 1 to pin 2 to supply optically isolated flags from A+15V input A+15V on P2 (JMACH) pin C30. E90 must have jump pins 1 to 2. Jump pins 2 to 3 to supply optically isolated flags from A+V input on the piggyback board (P2A pin C30).	Jumper installed
Note: This jumper setting is only relevant if E90 connects pin 1 to 2.			

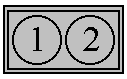
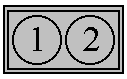
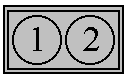
E90: Input Flag Supply Select

E Point & Physical Layout	Location	Description	Default
E90 	C2	Jump pin 1 to pin 2 to allow A=15V/OPT=V on P2 (JMACH) pin C30, (also installed see E89) to power "Opto" switch sensor inputs (including limits). Jump pin 2 to 3 to allow +12V from VME bus connector to power Opto switch sensor inputs (including limits). Optical isolation is then lost. See also E85, E87, and E88.	1-2 Jumper installed

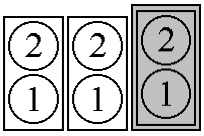
E93-95: Compare-Equal Output Voltage Configure

E Point & Physical Layout	Location	Description	Default
E93 	B2	Jump pin 1 to pin 2 to apply +V (+5V to 24V) to pin 11 of U28 (should be ULN2803A for sink output configuration). Jump pin 2 to 3 to apply GND to pin 11 of U28 (S/B UDN2981A for source output configuration).	1 to 2 jumper installed
E94 	B2	Jump pin 1 to 2 to apply GND to pin 10 of "U28" (should be ULN2803A for sink output configuration). Jump pin 2 to 3 to apply +V (+5V to 24V) to pin 10 of U28 (should be UDN2981A for source output configuration).	1 to 2 jumper installed
E95 	B2		1 to 2 jumper installed

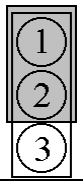
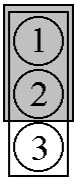
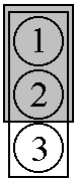
E96-E97-E99: Analog Source Isolate from Option 1V

E Point & Physical Layout	Location	Description	Default
E96 	C2	Jump 1-2 to connect A+15V on ACC-24V to A+15V on Option 1 piggyback board. Remove 1-2 to keep A+15V isolated between Option 1 board and main board.	Jumper installed
E97 	C2	Jump 1-2 to connect A-15V on ACC-24V board to A-15V on Option 1 piggyback board. Remove 1-2 to keep A-15V isolated between Option 1.	Jumper installed
E99 	C2	Jump 1-2 to connect AGND on main ACC-24V to AGND on Option 1 piggyback board. Remove 1-2 to keep AGD isolated between Option 1 board and main board.	Jumper installed

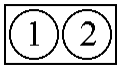
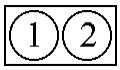
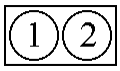
E98A-C: DAC/ADC Clock Frequency Control

E Point & Physical Layout	Location	Description	Default
 **E98C E98B E98A**	B3	Jump E98A pins 1-2 to provide an internally generated 2.45 MHz DCLK signal to DACs and ADCs. Jump E98B pins 1-2 to provide an internally generated 1.22 MHz DCLK signal to DACs and ADCs. Important for high accuracy A/D conversion on ACC-28A. Jumper E98C pins 1-2 to provide PMAC's DCLK signal through J5 pin 1, or J6 pin 10 to DACs and ADCs. (Not recommended.) Do not use if more than one ACC-24V connected to PMAC	1-2 Jumper installed

E100-103: Output Flag Supply Select

E Point & Physical Layout	Location	Description	Default
E100  	B2	Jump pin 1 to 2 to apply analog supply voltage A+15V to U11 flag output driver IC. Jump pin 2 to 3 to apply flag supply voltage OPT+V to U11 flag output driver IC.	1-2 Jumper installed
E101  	C2	**CAUTION** The jumper setting must match the type of driver IC, or damage to the IC will result. Jump pin 1 to 2 to apply +V (12V to 24V) to pin 10 of U11 (should be ULN2803A for sink output configuration) for AENA1-4 and EQU1-4 flag outputs. Jump pin 2 to 3 to apply AGND to pin 10 of U11 (should be UDN2981A for source output configuration) for AENA1-4 and EQU1-4 flag outputs.	1-2 Jumper installed
E102  	C2	**CAUTION** The jumper setting must match the type of driver IC, or damage to the IC will result. Jump pin 1 to 2 to AGND to pin 9 of U11 (should be ULN2803A for sink output configuration) for AENA1-4 and EQU1-4 flag outputs. Jump pin 2 to 3 to apply +V (12V to 24V) to pin 9 of U11 (should be UDN2981A for source output configuration) for AENA1-4 and EQU1-4 flag outputs.	1-2 Jumper installed

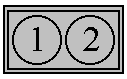
E185, E187, E188: Host-Supplied Analog Power Source Enable

E Point & Physical Layout	Location	Description	Default
E185 	Option 1 board	Jump pin 1 to pin 2 to allow A+14V to come from P1 (ties amplifier and PMAC-VME power supply together; defeats opto isolation). ***Note:*** If E185 is changed, E188 and E187 must also be changed; also see E190.	No jumper installed
E187 	Option 1 board	Jump pin 1 to pin 2 to allow analog GND to come from P1 (ties amplifier and PMAC-PC GND together. Defeats opto isolation). ***Note:*** If E185 is changed, E188 and E187 must also be changed; also see E190.	No jumper installed
E188 	Option 1 board	Jump pin 1 to pin 2 to allow A-14V to come from P1 (ties amplifier and ACC-24V power supply together defeats opto (coupling). ***Note:*** If E185 is changed, E188 and E187 must also be changed; also see E190.	No jumper installed

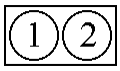
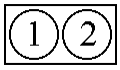
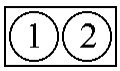
E189: Amplifier-Supplied Switch Pull-Up Enable

E Point & Physical Layout	Location	Description	Default
E189	Option 1 board	Jump pin 1 to 2 to allow A+15V/+V on P2A (JMACH4) pin 59, to tie to A+15V on P2 (JMACH3) pin C30. This jumper must be installed to allow A+15V to power the Opto switch sensor inputs (including limits) from the same opto-power supply that powers the amplifier output stage. Also, see E190.	Jumper installed

E190: Host-Supplied Switch Pull-Up Enable

E Point & Physical Layout	Location	Description	Default
E190 	Option 1 board	Jump pin 1 to 2 to allow A+15V/OPT+V on P2A (JMACH3) pin C30, (also see E189) to power "Opto" switch sensor inputs (including limits). Jump pin 2 to 3 to allow "+12V" from bus connector to power "Opto" switch sensor inputs (including limits). Optical isolation is then lost. See also E185, E187, and E188 and figure on PMAC opto isolation.	Jumper installed

E196, E197, E199: Analog Source Isolate from Main Board

E Point & Physical Layout	Location	Description	Default
E196 	Option 1 board	Jump 1-2 to connect A+15V on option 1 piggyback board to main ACC-24V board. Remove 1-2 to keep A+15V isolated between main board and piggyback board	No jumper installed
E197 	Option 1 board	Jump 1-2 to connect A-15V on Option 1V piggyback board to main ACC-24V board. Remove 1-2 to keep A-15V isolated between main board and piggyback board.	No jumper installed
E199 	Option 1 board	Jump 1 to 2 to connect AGND on Option 1V piggyback board to main ACC-24V board. Remove 1-2 to keep AGND isolated between main board and piggyback board.	No jumper installed

CONNECTOR DESCRIPTIONS

J1 and J2: Expansion Port Connector

J1 is a 50-pin IDC header connector that provides the connection to PMAC's JEXP Expansion Port.

J2 is a 50-pin IDC header connector that provides the connection to an ACC-14V JEXP Expansion Port, another ACC-24V JEXP port.

Contact the factory if pinout information is required.

Two 50-pin female flat cable connector. Delta Tau P/N: 014-R00F50-0K0, T&B Ansley, P/N 609-5041
171-50 T&B Ansley standard flat cable stranded 50-wire
Phoenix varioface module type FLKM 50 (male pins) P/N 22 81 08 9 used for daisy chaining ACC-14V (I/O) and ACC-24V

P2 – JMACH3 (96-Pin Header)

JVME standard VME connector, 96-pin VME connector AMLAN, P/N C96F3LA+B+C

P2A (96-Pin Header)				
Pin #	**Symbol**	**Function**	**Description**	**Notes**
A01	+5V	Output*	+5V Power	For Encoders
A02	GND	Common	PMAC Common	
A03	CH4C	Input	Encoder C Ch. Positive	Axis #4
A04	CH4C/	Input	Encoder C Ch. Negative	Axis #4 Do not GND if not used
A05	CH4B	Input	Encoder B Ch. Positive	Axis #4
A06	CH4B/	Input	Encoder B Ch. Negative	Axis #4 Do not GND if not used
A07	CH4A	Input	Encoder A Ch. Positive	Axis #4
A08	CH4A/	Input	Encoder A Ch. Negative	Axis #4 Do not GND if not used
A09	CH2C	Input	Encoder C Ch. Positive	Axis #2
A10	CH2C/	Input	Encoder C Ch. Negative	Axis #2 Do not GND if not used
A11	CH2B	Input	Encoder B Ch. Positive	Axis #2
A12	CH2B/	Input	Encoder B Ch. Negative	Axis #2 Do not GND if not used
A13	CH2A	Input	Encoder A Ch. Positive	Axis #2
A14	CH2A/	Input	Encoder A Ch. Negative	Axis #2 Do not GND if not used
A15	DAC4	Output	Ana. Out Positive 4	+/-10V to AGND
A16	DAC4/	Output	Ana. Out Negative 4	+/-10V to GND
A17	AENA4/DIR4	Output	Amp-Ena/Dir.4	Jumperable Polarity
A18	FAULT4	Input	Amp-Fault 4	High True
A19	+PLIM4**	Input	Positive Limit 4	Failsafe High True
A20	-NLIM4**	Input	Negative Limit 4	Failsafe
A21	HMFL4	Input	Home-Flag 4	Programmable Polarity
A22	DAC2	Output	Ana. Out Positive 2	+/-10V to AGND
A23	DAC2/	Output	Ana. Out Negative 2	+/-10V to AGND
A24	AENA2/DIR2	Output	Amp-Enable/Dir. 2	Jumperable Polarity
A25	FAULT2	Input	Amp-Fault 2	High True
A26	+MLIM2**	Input	Positive Limit 2	Failsafe High True
A27	-NLIM2**	Input	Negative Limit 2	Failsafe High True
A28	HMFL2	Input	Home-Flag 2	Programmable Polarity
A29	AGND	Input		Analog Common
A30	A-15V	Input		Analog -15V Supply
A31	GND	Common	PMAC Common	
A32	+5V	Output*	+5V Power	For Encoders
Note: In stand-alone applications, these can be used as +5V power supply inputs to power PMAC's digital circuitry.				

P2C (96-Pin Header)				
Pin #	**Symbol**	**Function**	**Description**	**Notes**
CO1	+5V	Output*	+5V Power	For Encoders
CO2	GND	Common	PMAC Common	
CO3	CH3C	Input	Encoder C Ch. Positive	Axis #3
CO4	CH3C/	Input	Encoder C Ch. Negative	Axis #3 Do not GND if not used
CO5	CH3B	Input	Encoder B Ch. Positive	Axis #3
CO6	CH3B/	Input	Encoder B Ch. Negative	Axis #3 Do not GND if not used
CO7	CH3A	Input	Encoder A Ch. Positive	Axis #3
CO8	CH3A/	Input	Encoder A Ch. Negative	Axis #3 Do not GND if not used
CO9	CH1C	Input	Encoder C Ch. Positive	Axis #1
C10	CH1C/	Input	Encoder C Ch. Negative	Axis #1 Do not GND if not used
C11	CH1B	Input	Encoder B Ch. Positive	Axis #1
C12	CH1B/	Input	Encoder B Ch. Negative	Axis #1 Do not GND if not used
C13	CH1A	Input	Encoder A Ch. Positive	Axis #1
C14	CH1A/	Input	Encoder A Ch. Negative	Axis #1 Do not GND if not used
C15	DAC3	Output	Ana. Out Positive 3	+/-10V to AGND
C16	DAC3/	Output	Ana. Out Negative 3	+/-10V to AGND
C17	AENA 3/DIR3	Output	Amp-Enable/Dir. 3	Jumperable Polarity
C18	FAULT3	Input	Amp-Fault 3	High True
C19	+PLIM3**	Output	Positive Limit 3	Failsafe High True
C20	-NLIM3**	Input	Negative Limit 3	Failsafe
C21	HMFL3	Input	Home-Flag 3	Programmable Polarity
C22	DAC1	Output	Ana. Out Positive 1	+/-10V to AGND
C23	DAC1/	Output	Ana. Out Negative 1	+/-10V to AGND
C24	AENA1/DIR1	Output	Amp-Enable/Dir. 1	Jumperable Polarity
C25	FAULT1	Input	Amp-Fault 1	High True
C26	+PLIM1**	Input	Positive Limit 1	Failsafe High True
C27	-NLIM1**	Input	Negative Limit 1	Failsafe High True
C28	HMFL1	Input	Home-Flag 1	Programmable Polarity
C29	ORST/	Output		Following Error Out
C30	A+15V	Input		Analog +15V Supply
C31	GND	Common	PMAC Common	
C32	+5V	Output*	+5V Power	For Encoders
The P2 connector is used to connect ACC-24V to the third four channels (Channels 1, 2, 3, and 4) of servo amps and motors. ** **Note:** Pins marked -LIMn should be connected to switches at the positive end of travel; pins marked +LIMn should be connected to switches at the negative end of travel.				

Note:

Normally, P2 connectors are used with ACC-8P or ACC-8D with Option V which provides complete terminal strip fan out of all connections.

ACC-8D	PMAC(1) 4-channel breakout board, monolithic terminal block, IDC headers	3D0-602205-10x
OPT-V	Option V - 40 cm (16 inch) cable with 96-pin DIN connector (200-602210-10X)	30V-0ACC8D-OPT
ACC-8P	PMAC(1) 4-channel breakout board, monolithic terminal block	3A0-FLKM60-000
OPT-V	Option V - 40 cm (16 inch) cable with 96-pin DIN connector	30V-0ACC8P-OPT

P2 – JMACH4 (96-Pin Header on Option 1V)

JVME – standard VME connector 96-pin, VME connector. AMLAN, P/N C96F3LA+B+C

P2A (96-Pin Header on Option 1V)				
Pin #	**Symbol**	**Function**	**Description**	**Notes**
A01	+5V	Output*	+5V Power	For encoders
A02	GND	Common	PMAC Common	
A03	CH8C	Input	Encoder C Ch. Positive	Axis #8
A04	CH8C/	Input	Encoder C Ch. Negative	Axis #8 Do not GND if not used
A05	CH8B	Input	Encoder B Ch. Positive	Axis #8
A06	CH8B/	Input	Encoder B Ch. Negative	Axis #8 Do not GND if not used
A07	CH8A	Input	Encoder A Ch. Positive	Axis #8
A08	CH8A/	Input	Encoder A Ch. Negative	Axis #8 Do not GND if not used
A09	CH6C	Input	Encoder C Ch. Positive	Axis #6
A10	CH6C/	Input	Encoder C Ch. Negative	Axis #6 Do not GND if not used
A11	CH6B	Input	Encoder B Ch. Positive	Axis #6
A12	CH6B/	Input	Encoder B Ch. Negative	Axis #6 Do not GND if not used
A13	CH6A	Input	Encoder A Ch. Positive	Axis #6
A14	CH6A/	Input	Encoder A Ch. Negative	Axis #6 Do not GND if not used
A15	DAC8	Output	Ana. Out Positive 8	+/-10V to AGND
A16	DAC8/	Output	Ana. Out Negative 8	+/-10V to AGND
A17	AENA 8/DIR8	Output	Amp-Ena/Dir.8	Jumperable Polarity
A18	FAULT8	Input	Amp-Fault 8	High True
A19	+LIM8**	Input	Positive Limit 8	Failsafe High True
A20	- LIM8**	Input	Negative Limit 8	Failsafe
A21	HMFL8	Input	Home-Flag 8	Programmable Polarity
A22	DAC6	Output	Ana. Out Positive 6	+/-10V to AGND
A23	DAC6/	Output	Ana. Out Negative 6	+/-10V to AGND
A24	AENA6/DIR6	Output	Amp-Enable/Dir. 6	Jumperable Polarity
A25	FAULT6	Input	Amp-Fault 6	High True
A26	+LIM6**	Input	Positive Limit 6	Failsafe High True
A27	-LIM6**	Input	Negative Limit 6	Failsafe High True
A28	HMFL6	Input	Home-Flag 6	Programmable Polarity
A29	AGND	Input		Analog Common
A30	A-15V	Input		Analog -15V Supply
A31	GND	Common	PMAC Common	
A32	+5V	Output*	+5V Power	For Encoders

P2C (96-Pin Header on Option 1V)				
Pin #	**Symbol**	**Function**	**Description**	**Notes**
CO1	+5V	Output*	+5V Power	For encoders
CO2	GND	Common	PMAC Common	
CO3	CH7C	Input	Encoder C Ch. Positive	Axis #7
CO4	CH7C/	Input	Encoder C Ch. Negative	Axis #7 Do not GND if not used
CO5	CH7B	Input	Encoder B Ch. Positive	Axis #7
CO6	CH7B/	Input	Encoder B Ch. Negative	Axis #7 Do not GND if not used
CO7	CH7A	Input	Encoder A Ch. Positive	Axis #7
CO8	CH7A/	Input	Encoder A Ch. Negative	Axis #7 Do not GND if not used
CO9	CH5C	Input	Encoder C Ch. Positive	Axis #5
C10	CH5C/	Input	Encoder C Ch. Negative	Axis #5 Do not GND if not used
C11	CH5B	Input	Encoder B Ch. Positive	Axis #5
C12	CH5B/	Input	Encoder B Ch. Negative	Axis #5 Do not GND if not used
C13	CH5A	Input	Encoder A Ch. Positive	Axis #5
C14	CH5A/	Input	Encoder A Ch. Negative	Axis #5 Do not GND if not used
C15	DAC7	Output	Ana. Out Positive 7	+/-10V to AGND
C16	DAC7/	Output	Ana. Out Negative 7	+/-10V to AGND
C17	AENA7/DIR7	Output	Amp-Ena/Dir.7	Jumperable Polarity
C18	FAULT7	Input	Amp-Fault 7	High True
C19	+LIM7**	Input	Positive Limit 7	Failsafe High True
C20	-LIM7**	Input	Negative Limit 7	Failsafe
C21	HMFL7	Input	Home-Flag 7	Programmable Polarity
C22	DAC5	Output	Ana. Out Positive 5	+/-10V to AGND
C23	DAC5/	Output	Ana. Out Negative 5	+/-10V to AGND
C24	AENA5/DIR5	Output	Amp-Ena/Dir.5	Jumperable Polarity
C25	FAULT5	Input	Amp-Fault 5	High True
C26	+LIM5**	Input	Positive Limit 5	Failsafe High True
C27	-LIM5**	Input	Negative Limit 5	Failsafe High True
C28	HMFL5	Input	Home-Flag 5	Programmable Polarity
C29	ORST/	Output		Following Err. Out
C30	A+15V	Input		Analog +15V Supply
C31	GND	Common	PMAC Common	
C32	+5V	Output*	+5V Power	For Encoders

The P2A connector is used to connect ACC-24V to fourth 4 channels (Channels 5, 6, 7 and 8) of servo amp and motors.

** **Note**: Pins marked -LIMn should be connected to switches at the *positive* end of travel; pins marked +LIMn should be connected to switches at the *negative* end of travel.

Note:

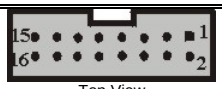
P2 connectors are normally used with accessory 8P or 8D with Option V, which provides complete terminal strip fan-out of all connections.

ACC-8D	PMAC(1) 4-channel breakout board, monolithic terminal block, IDC headers	3D0-602205-10x
OPT-V	Option V - 40 cm (16 inch) cable with 96-pin DIN connector (200-602210-10X)	30V-0ACC8D-OPT
ACC-8P	PMAC(1) 4-channel breakout board, monolithic terminal block	3A0-FLKM60-000
OPT-V	Option V - 40 cm (16 inch) cable with 96-pin DIN connector	30V-0ACC8P-OPT

J1 on Option 1V: A/D Port Connector

Two 16-pin flat cable connector Delta Tau, P/N: 014-R00F16-0K0, T&B Ansley, P/N 609-1641.
171-16 T&B Ansley standard flat cable stranded 16-wire
Phoenix varioface module type FLKM 16 (male pins) P/N 22 81 03 4

J1 on OPT-1 Board

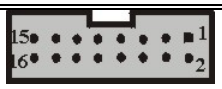


Top View

Pin #	Symbol	Function	Description	Notes
1	DCLK	Output	D to A, A to D Clock	DAC and ADC clock for Chan. 13,14,15,16
2	BDATA2	Output	D to A Data	DAC data for Chan. 5,6,7,8
3	ASEL2/	Output	Chan. Select Bit 0	Select for Chan. 5,6,7,8
4	ASEL3/	Output	Chan. Select Bit 1	Select for Chan. 5,6,7,8
5	CNVRT23	Output	A to D Convert	ADC convert sig. Chan 5,6,7,8
6	ADCIN2	Input	A to D Data	ADC data for Chan. 5,6,7,8
7	OUT5/	Output	Amp Enable/Dir	Amp Enable/Dir for Chan. 5
8	OUT6/	Output	Amp Enable/Dir	Amp Enable/Dir for Chan. 6
9	OUT7/	Output	Amp Enable/Dir	Amp Enable/Dir for Chan. 7
10	OUT8/	Output	Amp Enable/Dir	Amp Enable/Dir for Chan. 8
11	HF4-5	Input	Amp Fault	Amp Fault input for Chan. 5
12	HF4-6	Input	Amp Fault	Amp Fault input for Chan. 6
13	HF4-7	Input	Amp Fault	Amp Fault input for Chan. 7
14	HF4-8	Input	Amp Fault	Amp Fault input for Chan. 8
15	+5V	Output	+5V Supply	Power supply OUT
16	GND	Common	PMAC Common	
ACC-28A/B connection; digital amplifier connection.				

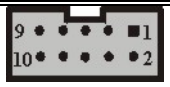
J5 and J9 (JS4) (16-Pin Header)

Two 16-pin flat cable connector Delta Tau, P/N: 014-R00F16-0K0, T&B Ansley, P/N 609-1641.
171-16 T&B Ansley standard flat cable stranded 16-wire
Phoenix varioface module type FLKM 16 (male pins) P/N 22 81 03 4

J5 and J9 (JS4) (16-Pin Header)			Top View 	
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	DCLK	Output	D to A, A to D Clock	DAC and ADC Clock
2	BDATA4	Output	D to A Data	DAC Data
3	ASEL6/	Output	Axis Select Bit 0	Select
4	ASEL7/	Output	Axis Select Bit 2	Select
5	CONVERT 67	Output	A to D Convert	ADC Convert Signal
6	ADCIN4	Input	A to D Data	ADC Data
7	OUT D/	Output	Amp Enable /Dir.	Amp Enable/Direction
8	OUT E/	Output	Amp Enable /Dir.	Amp Enable/Direction
9	OUTF/	Output	Amp Enable /Dir.	Amp Enable/Direction
10	OUTG/	Output	Amp Enable /Dir.	Amp Enable/Direction
11	HF4D	Input	Amp Fault	AMP Fault Input
12	HF4E	Input	Amp Fault	AMP Fault Input
13	HF4F	Input	Amp Fault	AMP Fault Input
14	HF4G	Input	Amp Fault	AMP Fault Input
15	+5V	Output	+5V Supply	Power Supply Out
16	GND	Common	PMAC Common	
Typically, miscellaneous I/O is used to interface with ACC-28 (the analog-to-digital converter board). J5 and J9 are wired together. J5 is on the front plate and J9 in the topside of the board.				

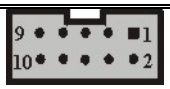
J6 –JXIO (10-Pin Connector)

Two 10-pin female flat cable connector Delta Tau, P/N: 014-R00F10-0K0, T&B Ansley, P/N 609-1041.
171-10 T&B Ansley standard flat cable stranded 10-wire
Phoenix varioface module type FLKM 16 (male pins) P/N 22 81 03 4

J6 –JXIO (10-Pin Connector)			Top View 	
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	CHA01+	Input		
2	CHB01+	Input		
3	CHC01+	Input		
4	CHA3+	Input		
5	CHB3+	Input		
6	CHC3+	Input		
7	NC			
8	NC			
9	SCLK	Output	System Clock	
10	DCLK	Output	Servo-Encoder Clock D to A, A to D Clock	Servo-Encoder Timing Clock DAC and ADC Clock for Channels 1 to 8
This connector can be used to bring external clocks, and for single ended encoder feedback for Channel 1 and Channel 3.				

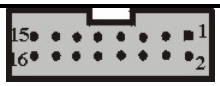
J7 (JEQU) Position Compare Output Connector

Two 10-pin female flat cable connector Delta Tau, P/N: 014-R00F10-0K0, T&B Ansley, P/N 609-1041.
171-10 T&B Ansley standard flat cable stranded 10-wire
Phoenix varioface module type FLKM 16 (male pins) P/N 22 81 03 4

J7 JEQU (10-Pin Connector)		Top View 		
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	EQU1/	Output	Encoder 1 COMP-EQ	Low is TRUE
2	EQU2/	Output	Encoder 2 COMP-EQ	Low is TRUE
3	EQU3/	Output	Encoder 3 COMP-EQ	Low is TRUE
4	EQU4/	Output	Encoder 4 COMP-EQ	Low is TRUE
5	EQU5/	Output	Encoder 5 COMP-EQ	(1) Low is TRUE
6	EQU6/	Output	Encoder 6 COMP-EQ	(1) Low is TRUE
7	EQU7/	Output	Encoder 7 COMP-EQ	(1) Low is TRUE
8	EQU8/	Output	Encoder 8 COMP-EQ	(1) Low is TRUE
9	+V	Supply	Positive Supply	+5V to +24V
10	GND	Common	Digital Ground	
This connector provides the position-compare outputs for the eight encoder channels. (1). These signals provided only if Option 1 is ordered.				

J8 (JS3) (16-Pin Header)

Two 16-pin flat cable connector Delta Tau, P/N: 014-R00F16-0K0, T&B Ansley, P/N 609-1641.
171-16 T&B Ansley standard flat cable stranded 16-wire
Phoenix varioface module type FLKM 16 (male pins) P/N 22 81 03 4

J8 (JS3) (16-Pin Header)			Top View 	
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	DCLK	Output	D to A, A to D Clock	DAC and ADC Clock for Ch. 1, 2, 3, 4
2	BDATA3	Output	D to A Data	DAC Data for Ch. 1, 2, 3, 4
3	ASEL4/	Output	Axis Select Bit 0	Select for Ch. 1, 2, 3, 4
4	ASEL5/	Output	Axis Select Bit 2	Select for Ch. 1, 2, 3, 4
5	CONVERT 45	Output	A to D Convert	ADC Convert Signal Ch. 1, 2, 3, 4
6	ADCIN3	Input	A to D Data	ADC Data for Ch. 1, 2, 3, 4
7	OUT1/	Output	Amp Enable /Dir.	Amp Enable/Direction for Ch. 1
8	OUT2/	Output	Amp Enable /Dir.	Amp Enable/Direction for Ch. 2
9	OUT3/	Output	Amp Enable /Dir.	Amp Enable/Direction for Ch. 3
10	OUT4/	Output	Amp Enable /Dir.	Amp Enable/Direction for Ch. 4
11	HF4_1	Input	Amp Fault	AMP Fault Input for Ch. 1
12	HF4_2	Input	Amp Fault	AMP Fault Input for Ch. 2
13	HF4_3	Input	Amp Fault	AMP Fault Input for Ch. 3
14	HF4_4	Input	Amp Fault	AMP Fault Input for Ch. 4
15	+5V	Output	+5V Supply	Power Supply Out
16	GND	Common	PMAC Common	
Typically, miscellaneous I/O is used to interface with ACC-28 (the analog-to-digital converter board).				

P1: VME Bus Connector

P1 is the standard 96-pin VME connector. If the ACC-24V is plugged into a VME socket using this connector, only the power and return pins are used.

JVME – standard VME connector
96-pin, VME connector. AMLAN, P/N C96F3LA+B+C

TB1: Standalone Power Supply Terminal Block

This terminal block can be used to provide the input for the power supply for the circuits on the ACC-24V board when it is not in a bus configuration. When the ACC-24V is in a bus configuration, these supplies come through the bus connector from the bus power supply automatically; in this case, this terminal block should not be used.

Pin #	Symbol	Function	Description	Notes
1	GND	Common	Reference Voltage	
2	+5V	Input	Digital Supply Voltage	Supplies all PMAC digital circuits
3	+12V	Input	Analog Positive Supply Voltage	E85, E87, E88 must be ON; no isolation from digital
4	-12V	Input	Analog Negative Supply Voltage	E85, E87, E88 must be ON; no isolation from digital